Strand 4: Geometry and Measurement

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Geometric Properties Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**	
	PO 1. Use the words vertex and side when describing simple two-dimensional geometric shapes.									
PO 1. Identify two-dimensional shapes by attribute (size, shape, number of sides).	PO 2. Identify two-dimensional shapes by attribute (size, shape, number of sides, vertices).									
PO 2. Identify concepts and terms of position and size in contextual situations: • Inside/ outside • Above/below /between • Smaller/ larger • Longer/ shorter.	PO 3. Use concepts and terms of position and size in contextual situations: • Inside/outside • Left/right • Above/below/ between • Smaller/larger • Longer/ shorter.									

Arizona Academic Content Standards: Mathematics Standard Articulated by Grade Level

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 3. Identify shapes in different environments. (e.g., nature, buildings, classroom, etc.)	PO 4. Name common two-dimensional shapes (square, rectangle, triangle, and circle).	PO 1. Compare attributes of two-dimensional shapes (square, rectangle, triangle, and circle).	PO 1. Build geometric figures with other common shapes. (e.g., tangrams, pattern blocks, geoboards)	PO 1. Identify the properties of two-dimensional figures using appropriate terminology.	PO 1. Recognize regular polygons.	PO 1. Classify polygons by their attributes. (e.g., number of sides, length of sides, angles, parallelism, perpendicularity)			PO 1. Identify the attributes of special triangles. (isosceles, equilateral, right)
	PO 5. Draw two-dimensional shapes. (square, rectangle, triangle, circle)				PO 2. Draw two-dimensional figures by applying significant properties of each. (e.g., Draw a quadrilateral with two sets of parallel sides and four right angles.)	PO 2. Draw a geometric figure showing specified properties, such as parallelism and perpendicularity.	PO 1. Draw a geometric figure showing specified properties. (e.g., Draw an obtuse triangle.)	PO 1. Draw a model that demonstrates basic geometric relationships such as parallelism, perpendicularity, similarity/ proportionality, and congruence.	PO 2. Identify the hierarchy of quadrilaterals.

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
			PO 2. Name concrete objects and pictures of three-dimensional solids (cones, spheres and cubes).	PO 2. Identify models or illustrations of prisms, pyramids, cones, cylinders and spheres.	PO 3. Sketch prisms, pyramids, cones, and cylinders.	PO 3. Classify prisms, pyramids, cones, and cylinders by base shape and lateral surface shape.			
					PO 4. Identify the properties of two- and three-dimensional geometric figures using appropriate terminology and vocabulary.	PO 4. Classify three-dimensional figures by their attributes.	PO 2. Classify three-dimensional solids by their configuration and properties. (e.g., parallelism, perpendicu-larity and congruency)	PO 2. Draw three-dimensional figures by applying properties of each. (e.g., parallelism, perpendicu-larity and congruency)	

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
			PO 3. Describe relationships between two-dimensional and three-dimensional objects. (squares/ cubes, circles/ spheres, triangles/ cones)			PO 5. Compare attributes of two-dimensional figures with three-dimensional figures.	PO 3. Identify the net (two-dimensional representation) that corresponds to a rectangular prism, cone, or cylinder.	PO 3. Recognize the three-dimensional figure represented by a net.	PO 3. Make a net to represent a three-dimensional object.
							PO 4. Distinguish between length, area, and volume, using two- and three-dimensional geometric figures.	PO 4. Represent the surface area of rectangular prisms and cylinders as the area of their net.	PO 4. Make a three-dimensional model from a net.

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
				PO 3. Draw points, lines, line segments (open or closed endpoints), rays or angles.	PO 5. Draw points, lines line segments, rays, and angles with appropriate labels.	PO 6. Draw triangles with appropriate labels.	PO 5. Draw polygons with appropriate labels.	PO 5. Draw regular polygons with appropriate labels.	PO 5. Draw 2-dimensional and 3-dimensional figures with appropriate labels.
				PO 4. Classify angles. (e.g., right, acute, obtuse, straight)	PO 6. Recognize that all pairs of vertical angles are congruent.	PO 7. Identify supplementary or complementary angles.	PO 6. Identify the angles created by two lines and a transversal.	PO 6. Identify the properties of angles created by a transversal intersecting two parallel lines (e.g., corresponding angles are congruent).	PO 6. Solve problems related to complementary, supplementary, or congruent angle concepts.
				PO 5. Classify triangles as right, acute, or obtuse.	PO 7. Classify triangles as scalene, isosceles, or equilateral.		PO 7. Recognize the relationship between central angles and intercepted arcs.	PO 7. Recognize the relationship between inscribed angles and intercepted arcs.	PO 7. Solve problems by applying the relationship between circles, angles, and intercepted arcs.

Arizona Academic Content Standards: Mathematics Standard Articulated by Grade Level

Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
					PO 8. Recognize that a circle is a 360° rotation about a point.				
					PO 9. Identify the diameter, radius and circumference of a circle.	PO 8. Identify the diameter, radius and circumference of a circle or sphere.	PO 8. Identify arcs and chords of a circle.	PO 8. Identify tangents and secants of a circle.	PO 8. Solve problems by applying the relationship between radii, diameters, chords, tangents or secants.
					PO 10. Understand that the sum of the angles of a triangle is 180°.		PO 9. Model the triangle inequality theorem using manipulatives.	PO 9. Determine whether three given lengths can form a triangle.	PO 9. Solve problems using the triangle inequality property.

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Concept 1: Geometric Properties
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 10. Solve problems using special case right triangles.
		PO 2. Recognize congruent shapes.		PO 6. Identify congruent geometric shapes.	PO 11. Draw two congruent geometric figures.		PO 10. Identify corresponding parts of congruent polygons as congruent.		PO 11. Determine when triangles are congruent by applying SSS, ASA, AAS or SAS.
			PO 4. Recognize similar shapes.	PO 7. Identify similar shapes.	PO 12. Draw two similar geometric figures.			PO 10. Identify corresponding angles of similar polygons as congruent and sides as proportional.	PO 12. Determine when triangles are similar by applying SAS, SSS, or AA similarity postulates.
									PO 13. Construct a triangle congruent to a given triangle.

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Concept 1: Geometric Properties									
Analyze the attributes and properties of two and three dimensional shapes and develop mathematical arguments about their relationships.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
	PO 6. Recognize where a line of symmetry divides a two-dimensional shape into mirror images.	PO 3. Recognize line(s) of symmetry for a two-dimensional shape.	PO 5. Identify a line of symmetry in a two-dimensional shape.	PO 8. Draw a two-dimensional shape that has line symmetry.	PO 13. Identify the lines of symmetry in a two-dimensional shape.	PO 9. Draw a two-dimensional shape with a given number of lines of symmetry.			PO 14. Solve contextual situations using angle and side length relationships.

Strand 4: Geometry and Measurement

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Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 2: Transformation of Shapes Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
	PO 1. Recognize same shape in different positions (slide/ translations).	PO 1. Recognize same shape in different positions (flip/reflection).	PO 1. Recognize same shape in different positions (turn/rotation).	PO 1. Demonstrate translation using geometric figures.	PO 1. Demonstrate reflections using geometric figures.	PO 1. Identify reflections, and translations using pictures.	PO 1. Identify rotations about a point, using pictorial models.	PO 1. Identify the planar geometric figure that is the result of a given rigid transformation.	PO 1. Sketch the planar figure that is the result of two or more transformations.
				PO 2. Identify a tessellation.	PO 2. Describe the transformations that created a tessellation.	PO 2. Perform elementary transformations to create a tessellation.	PO 2. Recognize simple single rotations, translations or reflections on a coordinate grid.	PO 2. Model a simple transformation on a coordinate grid. (e.g. translate right four units and down two units)	PO 2. Identify the properties of the planar figure that is the result of two or more transformations.
									PO 3. Determine the new coordinates of a point when a single transformation is performed on a planar geometric figure.

Strand 4: Geometry and Measurement

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Concept 2: Transformation of Shapes Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
									PO 4. Determine whether a given pair of figures on a coordinate plane represents a translation, reflection, rotation, or dilation.
									PO 5. Classify transformations based on whether they produce congruent or similar figures.
									PO 6. Determine the effects of a single transformation on linear or area measurements of a planar geometric figure.

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Concept 3: Coordinate Geometry Specify and describe spatial relationships using coordinate geometry and other representational systems.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
			PO 1. Identify points in the first quadrant of a grid using ordered pairs.	PO 1. Name the coordinates of a point plotted in the first quadrant.	PO 1. Graph points in the first quadrant on a grid using ordered pairs.	PO 1. Graph a polygon in the first quadrant using ordered pairs.	PO 1. Graph data points in (x, y) form in any quadrant of a coordinate grid.	PO 1. Use a table of values to graph a linear equation.	PO 1. Graph a quadratic equation with lead coefficient equal to one.
						PO 2. State the missing coordinate of a given figure in the first quadrant of a coordinate grid using geometric properties. (e.g. find the coordinates of the missing vertex of a rectangle when two adjacent sides are drawn)	PO 2. State the missing coordinate of a given figure in any quadrant of a coordinate grid using geometric properties. (e.g. find the coordinates of the missing vertex of a rectangle when two adjacent sides are drawn)		PO 2. Graph a linear equation in two variables.
									PO 3. Graph a linear inequality in two variables.

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Concept 3: Coordinate Geometry Specify and describe spatial relationships using coordinate geometry and other representational systems.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
									PO 4. Determine the solution to a system of equations in two variables from a given graph.
								PO 2. Determine the midpoint given two points on a number line.	PO 5. Determine the midpoint between two points in a coordinate system.
									PO 6. Determine changes in the graph of a linear function when constants and coefficients in its equation are varied.
								PO 3. Determine the distance between two points on a number line.	PO 7. Determine the distance between two points in the coordinate system.

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<table>
<tr><td colspan="10" align="center">Concept 4: Measurement - Units of Measure
- Geometric Objects
Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.</td></tr>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>High School</th></tr>
<tr>
<td>PO 1. Verbally compare objects according to observable and measurable attributes.</td>
<td>PO 1. Compare the measurable characteristics of two objects. (e.g., length weight, and size)</td>
<td>PO 1. Identify the type of measure (e.g., weight, height, and time) for each attribute of an object.</td>
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<tr>
<td>PO 2. Communicate orally how different attributes of an object can be measured.</td>
<td>PO 2. Select the appropriate measure of accuracy -
• length – inches, feet
• capacity/ volume – cups, gallons
• mass/weight – pounds.</td>
<td>PO 2. Select the appropriate U.S. customary measure of accuracy -

• length – inches , feet, yards, miles
• capacity/volume – pints, quarts
• mass/weight – ounces.</td>
<td>PO 1. Select the appropriate measure of accuracy -
• length – centimeters , meters; kilometers
• capacity/ volume – liters
• mass/weight – grams.</td>
<td>PO 1. Identify the appropriate measure of accuracy for the area of an object. (e.g., sq. ft. or sq. miles)</td>
<td>PO 1. State an appropriate measure of accuracy - for a contextual situation (e.g., "What unit of measurement would you use to measure the top of your desk?")</td>
<td>PO 1. Determine the appropriate measure of accuracy - within a system for a given contextual situation. (e.g. would you measure the length of your bedroom wall using inches or feet)</td>
<td>PO 1. Identify the appropriate unit of measure for the volume of an object. (e.g., cubic inches or cubic cm)</td>
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<td></td>
</tr>
</table>

Strand 4: Geometry and Measurement

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Concept 4: Measurement - Units of Measure - **Geometric Objects** Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
	PO 3. Tell time to the hour using analog and digital clocks.	PO 3. Tell time to the quarter hour using analog and digital clocks.	PO 2. Tell time with one-minute precision (analog).						
	PO 4. Name the days of the week for yesterday, today and tomorrow. (e.g., If today is Wednesday, what day will it be tomorrow?)	PO 4. Determine the passage of time using units of days and weeks within a month using a calendar.	PO 3. Determine the passage of time across months (i.e., units of days, weeks, months) using a calendar	PO 2. Compute elapsed time using a clock (e.g., hours and minutes since or until…) or a calendar (e.g., days, weeks, years since or until…).					
	PO 5. Name the 12 months of the year in proper order starting with January.								
	PO 6. Name the 7 days of the week in proper order starting with Sunday.								

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Concept 4: Measurement - Units of Measure - **Geometric Objects** Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
		PO 5. Select the appropriate tool to measure the given characteristic of an object.		PO 3. Select an appropriate tool to use in a particular measurement situation.		PO 2. Determine the appropriate tool needed to measure to the needed accuracy.			
	PO 7. Measure a given object using the appropriate unit of measure - • length – inches, feet and yards • capacity/volume – cups, gallons • mass/weight - pounds.	PO 6. Measure a given object using the appropriate unit of measure- • length – inches, miles • capacity/volume – pints, quarts • mass/weight – ounces.	PO 4. Measure a given object using the appropriate unit of measure - • length – centimeters, millimeters, meters, kilometers • capacity/volume – liters mass/weight – grams.	PO 4. Approximate measurements to the appropriate degree of accuracy.	PO 2. Draw two-dimensional figures to specifications using the appropriate tools. (e.g., draw a circle with a 2 inch radius)	PO 3. Determine a linear measurement to the appropriate degree of accuracy.	PO 2. Measure to the appropriate degree of accuracy.		
			PO 5. Record temperatures to the nearest degree in degrees Fahrenheit and degrees Celsius as shown on a thermometer.			PO 4. Measure angles using a protractor.			

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Concept 4: Measurement - Units of Measure
- **Geometric Objects**
Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
			PO 6. Compare units of measure to determine more or less relationships for - • length – inches to feet; centimeters to meters; • time – minutes to hours; hours to days; days to weeks; months to years; and money – pennies, nickels, dimes, quarters and dollars.	PO 5. Compare units of measure to determine *more* or *less* relationships including - • length -yards and miles, meters and kilometers and • weight - pounds and tons, grams and kilograms.					

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Strand 4: Geometry and Measurement

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colspan Concept 4: Measurement - Units of Measure									

Concept 4: Measurement - Units of Measure
- **Geometric Objects**

Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 3. Order objects according to observable and measurable attributes.		PO 7. State equivalent relationships: • 12 inches = 1 foot • 60 minutes = 1 hour • 24 hours = 1 day • 7 days = 1 week • 12 months = 1 year • 100 pennies = 1 dollar • 10 dimes = 1 dollar • 4 quarters = 1 dollar.	PO 7. Determine relationships for - • volume – cups and gallons, • weight – ounces and pounds, and • money – extend to amounts greater than one dollar.	PO 6. State equivalent relationships. (e.g., 3 teaspoons = 1 Tablespoon, 16 cups = 1 gallon, 2000 pounds = 1 ton)	PO 3. Determine relationships including volume (e.g., pints and quarts, milliliters and liters).				
			PO 8. Compare the length of two objects using U.S. customary or metric units.	PO 7. Compare the weight of two objects using both U.S. customary and metric units.	PO 4. Convert measurement units to equivalent units within a given system (U.S. customary and metric). (e.g., 12 inches = 1 foot, 10 decimeters = 1 meter)	PO 5. Convert within a single measurement system (US customary or metric). (e.g. how many ounces are equivalent to 2 pounds?)	PO 3. Convert a measurement from US customary to metric, and vice versa.		

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Concept 4: Measurement - Units of Measure - **Geometric Objects** Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.									
Kindergarten	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**	**Grade 7**	**Grade 8**	**High School**
			PO 9. Determine the perimeter using a rectangular array.	PO 8. Determine perimeter of simple polygons. (e.g. square, rectangle, triangle)	PO 5. Solve problems involving perimeter of convex polygons.	PO 6. Solve problems involving the perimeter of polygons.	PO 4. Solve problems involving the circumference of a circle.		
						PO 7. Determine the area of triangles.			
			PO 10. Represent area using a rectangular array.	PO 9. Determine area of squares and rectangles.	PO 6. Determine the area of figures composed of two or more rectangles on a grid.	PO 8. Distinguish between the perimeter and area in contextual situation.	PO 5. Solve problems involving the area of a circle.		
					PO 7. Solve problems involving area of simple polygons.	PO 9. Solve problems for the areas of parallelograms (includes rectangles).	PO 6. Solve problems for the areas of parallelograms, triangles, and circles.	PO 1. Solve problems for the area of a trapezoid.	PO 1. Calculate the area of geometric shapes composed of two or more geometric figures.

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Concept 4: Measurement - Units of Measure
- **Geometric Objects**

Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
								PO 2. Solve problems involving the volume of rectangular prisms and cylinders.	PO 2. Calculate the volumes of three-dimensional geometric figures.
								PO 3. Calculate the surface area of rectangular prisms or cylinders.	PO 3. Calculate the surface areas of three-dimensional geometric figures.
				PO 10. Differentiate between perimeter and area of quadrilaterals.	PO 8. Describe the change in perimeter or area when one attribute (length, width) of a rectangle is altered.	PO 10. Identify parallelograms having the same perimeter or area.	PO 7. Identify polygons having the same perimeter or area.	PO 4. Identify rectangular prisms and cylinders having the same volume.	PO 4. Compare perimeter, area, or volume of figures when dimensions are changed.
									PO 5. Find the length of a circular arc.

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Concept 4: Measurement - Units of Measure
- Geometric Objects
Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 6. Find the area of a sector of a circle.
									PO 7. Solve for missing measures in a pyramid. (i.e., slant height, height)
								PO 5. Find the measure of a missing interior angle in a triangle or quadrilateral.	PO 8. Find the sum of the interior and exterior angles of a polygon.
						PO 11. Determine the actual measure of objects using a scale drawing or map.	PO 8. Compare estimated to actual lengths based on scale drawings or maps.	PO 6. Solve problems using ratios and proportions, given the scale factor.	PO 9. Solve scale factor problems using ratios and proportions.
								PO 7. Calculate the length of a side given two similar triangles.	PO 10. Solve applied problems using similar triangles.

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